

# INDUCTION HEATING APPARATUS

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

The present invention relates to an induction heating apparatus, and more particularly to an induction heating apparatus suitable for sealing various sizes of bottles.

### 2. Description of Related Art

Bottles are used to hold drinks, liquid or the like. In the market, various products for drinking are held in bottles. A bottle generally has a mouth, and a cap is attached to the mouth to seal the bottle to keep the liquid in the bottle from flowing out. A method of sealing bottles, called induction heating sealing, was developed over ten years ago. Induction heating sealing is a non-contact heating process that hermetically seals a bottle with a non-tampering seal. The non-tampering seal may include a layer of foam, wax, aluminum foil and heat active polymer that is compatible with the bottle material.

When an electromagnetic field is applied over the non-tampering seal that is mounted in the cap on the mouth of the bottle, the electromagnetic field induces in the aluminum foil and heats the aluminum foil. The heat in the aluminum foil will be transferred to the non-tampering seal and melt the heat active polymer that will quickly bond the non-tampering seal and the bottle.

However, the sizes of bottles today vary significantly. Conventional induction heating apparatus only can be used for a given size bottle. If the bottle size is increased, the conventional induction heating apparatus needs to be replaced with a suitable large one. However, to prepare various sizes of induction

1 heating apparatus to accommodate each size of bottle in a factory will greatly  
2 increase cost for manufactures. Also, replacing conventional induction heating  
3 apparatus to accommodate a specific bottle size will require time for a  
4 technician.

5 To overcome the shortcomings, the present invention provides an  
6 induction heating apparatus suitable for various sizes of containers to mitigate or  
7 obviate the aforementioned problems.

#### 8 SUMMARY OF THE INVENTION

9 The main objective of the invention is to provide an induction heating  
10 apparatus suitable for sealing various sizes of containers, such as bottles.

11 Other objectives, advantages and novel features of the invention will  
12 become more apparent from the following detailed description when taken in  
13 conjunction with the accompanying drawings.

#### 14 BRIEF DESCRIPTION OF THE DRAWINGS

15 Fig. 1 is an exploded perspective view of an induction heating apparatus  
16 in accordance with the present invention;

17 Fig. 2 is a perspective view of the induction heating apparatus in Fig. 1;

18 Fig. 3 is an operational cross sectional side plan view of the induction  
19 heating apparatus along line 3-3 in Fig. 2 when the induction heating apparatus is  
20 used for a small size bottle; and

21 Fig. 4 is an operational cross sectional side plan view of the induction  
22 heating apparatus in Fig. 1 when the induction heating apparatus is used for a  
23 large size bottle.

#### 24 DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

1           With reference to Fig. 1, an induction heating apparatus for sealing a  
2 container with a non-tampering seal comprises a concentrator (10) and a coil  
3 assembly (20). The concentrator (10) is made of paramagnetic materials and  
4 includes a central core (11), a base (not numbered), outside walls (13) and inside  
5 walls (14). The base has a center (not shown) and four sector bases (12) arranged  
6 around the center. The central core (11) is formed on and extends from the center  
7 of the base. Each sector base (12) has an outside edge (not numbered) around the  
8 center and is displaced from each adjacent sector base (12) by an angular  
9 displacement of 45°. The outside walls (13) are integrally formed respectively  
10 from the sector bases (12) at the outside edges. The outside walls (13) are  
11 perpendicular to the sector bases (12) and encircle the central core (11). The  
12 inside walls (14) are respectively and integrally formed from the sector bases (12)  
13 between the central core (11) and the outside walls (13).

14           The coil assembly (20) is mounted in the concentrator (10) between the  
15 central core (11) and the outside walls (13) and comprises a large coil device (21)  
16 and a small coil device (22). With adaptation of the concentrator (10), more than  
17 two coil devices could be used. Both the large and small coil devices (21, 22)  
18 have a similar structure, and each comprises a bobbin (211, 221), an insulated  
19 electrical conductor (212, 222) and an insulator (214, 224). Each bobbin (211,  
20 221) comprises a central tube (215, 225) and two flanges (213, 223). Each  
21 central tube (215, 225) has two ends, and a flange (213, 223) is respectively  
22 formed around each end of each central tube (215, 225). The insulated electrical  
23 conductors (211, 222) are wound respectively around the central tubes (215, 225)  
24 between the flanges (213, 223). The insulators (214, 224), such as insulating tape,

1 are wound respectively around the insulated electrical conductors (212, 222) to  
2 protect the insulated electrical conductors (212, 222). The large coil device (21)  
3 is mounted in the concentrator (10) between the inside walls (14) and the outside  
4 walls (13). The small coil device (22) is mounted in the concentrator (10)  
5 between the central core (11) and the inside walls (14).

6 With reference to Figs. 3, the induction heating apparatus can be used to  
7 seal a small bottle (not numbered) with a small non-tampering seal (not shown).  
8 The small non-tampering seal includes layers of foam, wax, aluminum foil and  
9 heat active polymer and is mounted in a cap (not numbered) that is screwed onto  
10 the small bottle. The insulated electrical conductors (212, 222) are respectively  
11 and electrically connected to a power source (not shown) that supplies  
12 alternating current into the insulated electrical conductors (212, 222). The  
13 alternating current in each insulated electrical conductor (212, 222) has the same  
14 frequency and phase. When the alternating current is applied to the insulated  
15 electrical conductors (212, 222), a time-varying electromagnetic field (B) is  
16 created by the alternating current in both the large and the small coil devices (21,  
17 22). The flux of the electromagnetic field (B) will induce in the aluminum foil  
18 (not shown) of the small non-tampering seal to heat the aluminum foil. The heat  
19 in the aluminum foil will be transferred to the heat active polymer and melt the  
20 heat active polymer that will quickly bond the small non-tampering seal and the  
21 small bottle.

22 With reference to Fig. 4, the induction heating apparatus can be used to  
23 seal a large bottle (not numbered) with a large non-tampering seal (not shown).  
24 Because the electromagnetic field (B) created by the large coil device (21) will

1 induce in the large non-tampering seal, the induction heating apparatus induces  
2 in the aluminum foil of the large non-tampering seal to seal the large bottle.

3         The induction heating apparatus has a capability to hermetically seal  
4 larger sizes of bottles by adding additional outside walls (13) and inside walls  
5 (14) and coil assemblies and the sector bases (12). Manufactures would not need  
6 to replace the induction heating apparatus to accommodate any specific sizes of  
7 containers. The invention would save quite a lot of time and money for the  
8 manufacturers that seal numerous containers of different sizes.

9         Even though numerous characteristics and advantages of the present  
10 invention have been set forth in the foregoing description, together with details  
11 of the structure and function of the invention, the disclosure is illustrative only,  
12 and changes may be made in detail, especially in matters of shape, size, and  
13 arrangement of parts within the principles of the invention to the full extent  
14 indicated by the broad general meaning of the terms in which the appended  
15 claims are expressed.